Interactive comment on "The climate of the Mediterranean basin during the Holocene from terrestrial and marine pollen records: A model/data comparison" *by* Odile Peyron et al.

Anonymous Referee #2

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Review of "The climate of the Mediterranean basin during the Holocene from terrestrial and marine pollen records: A model/data comparison" by Peyron et al.

The paper presents climate reconstructions based on a set of pollen sequences in the Mediterranean basin for two time periods (early/late Holocene). They use the results to explore spatial patterning of past climate change, and further compare these to regional climate model output. The study is well set up, with very good background and the results are clearly displayed. I struggled, however, in understanding what the message of the paper was. The discussion is focused on the two possible spatial patterns (North-South and East-West), and on a comparison with the model output, but I didn't feel that these were really pulled together. If the goals was to understand

these patterns, then I feel that there is a missed opportunity in using the model output to understand the atmospheric drivers of the changes in spatial pattern. If the goal is purely a comparison, then the discussion on spatial patterning is much less relevant, other than as a benchmark. I would like to see the goals more clearly stated, and clearly referred to throughout the paper.

I would like to see more discussion about the choices of spatial pattern and of time period. I understand that the goal is to show both a latitudinal and longitudinal gradient, but the pattern often looks more complex. I was hoping that one outcome here would be a more synoptic view of the Mediterranean Holocene climate, considering the entire spatial pattern and the potential drivers of this. For the time period, I don't really understand why the authors did not look across the entire Holocene, but instead focused on two, quite long time periods. Are these gradients only a feature of the time periods chosen? What was the variation outside (or even within) these periods? Given that one of the papers they cite has already completed full Holocene reconstructions (Mauri et al., 2015), and that there is interest in full Holocene/Glacial transient GCM simulations, this snapshot approach appears to be somewhat limited. At the very least, it would be good to have a better justification for the choices than "to aid interpretability".

The choice of precipitation as a variable for comparison also needs better justification. The authors state (line 416) that using precipitation instead of moisture indices may be why there is a model/data mismatch, and some form of moisture index has been proposed as a better quantity for pollen reconstructions elsewhere (Bartlein et al., 2011). Given this, and that alpha is routinely reconstructed from pollen, why not use this instead? And if not, please justify the use of precipitation, given its limitation as a reconstructed variable.

Minor comments follow:

Line 28. The abstract could be shortened and made more concise – there is some repetition (e.g. lines 39-40 and lines 60-61)

Line 34 (and elsewhere). Is the pattern a gradient or dipole? These are not to my understanding the same thing, as one represents a trend, and the other represents a pattern of two opposing centers. Please either use one or the other, or state more clearly which is being referred to at any time.

Line 38-40. What is the aim of the comparison?

Lines 47-51. This section needs some rewriting to make it clear when the authors are referring to conditions being drier in one region than another, or that the anomalies are drier compared to another time period.

Line 61. In what sense is HadSM3 dynamic? (and what is HadSM3 as opposed to the other models shown here)

Lines 90-92. Needs a citation

Line 93. Which sites in N. Italy? Citation, please.

Lines 126-127. Why these periods? Why are they 'key'? Why not do this in a continuous way?

Lines 133-134. "To critically assess the potential of the model setup…" This is a little fuzzy, but I assume that the goal is to discuss the regional climate model output, and the model parameters. However, I don't really feel that this was addressed in the discussion. There is some discussion of findings in other papers (e.g. Bosmans et al) but nothing about the setup used here.

Line 169. Arguably, pine is overrepresented in all sites. Why only exclude it for the marine sites? How big an impact does this have?

Line 187. I think I get what the authors are saying here, but given the increasing interest in transient simulations (e.g. Liu et al) and reconstructions (e.g. Marcotte et al), I'd like to see this choice justified a little better

Line 190. The model uses the pre-industrial period as a baseline for anomalies,

whereas I assume the pollen reconstructions use the late 20th century, although this is not specified. How much will this affect the offset between model and data. How big are the reconstructed anomalies relative to any change between these periods?

Line 206. The results are more single points in time, rather than climate trends

Lines 217-219. This seems like it would be more appropriate in the introduction

Line 231. What scaling issues?

Line 247. It is difficult to see visually how there is good corroboration between thes results and Mauri et al. Would it be possible to carry out a one-to-one comparison of values, and test the differences? Further – as both Mauri et al, and this study present statistical climate reconstructions from pollen data, it is hard to see how the agreement between them supports the robustness of the results.

Line 351. How can you tell that the data-model agreement is good? Again, some point-by-point comparison would help (and help highlight where the main differences are)

Line 435. How would the snowpack affect different methods? I can see that it might affect proxies differently, but not methods.

Line 486. It is hard to disagree with a call for higher resolution in climate models, but how exactly will this help? What processes will be better represented, allowing for better climate simulation?